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OMI TADAHIRO;  
TSUBOUCHI KAZUO;  
ASAMI KINICHIRO;  
SHIMA MASAHIRO;**Assignee:** OMI TADAHIRO  
HITACHI PLANT ENG & CONSTR CO LTD  
[News](#), [Profiles](#), [Stocks](#) and [More about this company](#)**Published / Filed:** 1987-04-03 / 1985-09-25**Application** JP1985000211778**Number:****IPC Code:** F24F 7/06; E04B 5/52; F21S 1/02;**Abstract:**

PURPOSE: To illuminate with a white light including no ultraviolet ray and similar to natural light, and at the same time to eliminate a zone of dust drift caused by the installation of lighting apparatus, by disposing light emitting diodes for illumination on the surface of a ceiling of a clean room into which clean air is blown through a filter of high performance.

CONSTITUTION: In the ceiling of a clean room 10 HEPA (high performance) filters 16 are provided, on the bottom surface 23 thereof a plurality of red light emitting diodes 38R, green light emitting diodes 38G, and blue light emitting diodes 38B being disposed. These diodes are arranged alternately in serial order, so that the primary colors of red, green and blue light are combined to produce a white light. Since said white light is similar to a natural light and also the light from a light emitting diode comprises single wavelength and includes no ultraviolet ray, there is no bad influence on the operation of exposure to light in the manufacture of semiconductors.

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5 Title of the Invention: CLEAN ROOM ILLUMINATION DEVICE

Inventors: Noboru Nakashima et al.

Applicant: Tadahiro Omi, Hitachi Plant Kensetsu Kabushiki  
Kaisha

10 1. Title of the Invention  
CLEAN ROOM ILLUMINATION DEVICE

2. SCOPE OF CLAIMS:

(1) In a clean room into which is blown clean air that  
15 has passed through a high-performance filter mounted in the  
ceiling and from which is discharged air suctioned from the  
room, a clean room illumination device characterized by  
having light-emitting diodes arrayed on the ceiling surface.

(2) The clean room illumination device of Claim 1,  
20 wherein red color light-emitting diodes are used as the  
light-emitting diodes.

5 [sic] The clean room illumination device of Claim 1,  
wherein red color light-emitting diodes, green color light-  
emitting diodes, and blue color light-emitting diodes are  
25 used as the light-emitting diodes.

(4) The clean room of Claim 1, wherein the light-  
emitting diodes, which functions as the light-emitting diode  
illumination source having a plurality of light-emitting  
wavelengths, is mounted on a punching board.

30 (5) The clean room illumination device of Claim 1,  
wherein the light-emitting diodes are provided on a mounting  
member suspended from the ceiling.

(6) The clean room illumination device of Claim 1, wherein the light-emitting diodes are mounted on the bottom end part of a spacer of the high-performance filter.

5           3. DETAILED DESCRIPTION OF THE INVENTION

          FIELD OF THE INVENTION

          The present invention relates to an illumination device for a clean room, and specifically relates to an illumination device applicable to a clean room in a  
10 semiconductor manufacturing plant and the like.

          BACKGROUND OF THE INVENTION

          Since semiconductor manufacturing requires a dust-free environment, fabrication is normally performed within a  
15 clean room. Generally, clean rooms use an air circulation method to blow into the room clean air that has passed through a plurality of HEPA (high performance) filters mounted on a ceiling surface, and air within the room is suctioned from the floor and is again passed through the  
20 HEPA filter on the ceiling. FIG. 8 is an illustration showing a conventional circulation-type clean room. In the drawing, a ceiling space 12 of a clean room 10 is provided with an intake 14 on the right side of the drawing, such that circulating air passes through the intake 14 and is  
25 supplied to the ceiling space 12. Furthermore, a plurality of HEPA filters 16 and 16 are disposed in the ceiling space 12, and a punching board 18 is provided beneath the HEPA filters 16, such that the air in the ceiling space 12 is sent through the HEPA filters 16 and the punching board 18  
30 into the room 20. Furthermore, a beam 22 is disposed between the HEPA filters 16 and 16, and a fluorescent light 24 for illuminating the room interior 20 is mounted on the bottom surface 22a of the beam 22. Various types of

semiconductor manufacturing equipment 26 are arranged in the room interior 20.

A plurality of supports 30 are disposed upright on a base floor 28, and a floor grating 32 is supported by these  
5 supports 30, such that air in the room interior 20 is suctioned through the grating 32 into a subfloor chamber 34. A discharge port 36 is provided on the right side surface of the chamber 34, such that the air within the chamber 34 is suctioned from the discharge port 36, and is again  
10 introduced into the intake 14 of the ceiling space 12 through an air-conditioning device and duct not shown in the drawing.

Generally, in semiconductor manufacturing processes, an IC circuit pattern is printed onto a wafer using a  
15 photographic technology using a stepper (reduction projection-type optical exposure device). That is, an optical exposure process is required wherein a photosensitive resin is applied to a silicon wafer, and a circuit pattern is burned via exposure to light emitted from  
20 above.

Accordingly, when a fluorescent light 24 is used for illumination in the clean room, there is a serious adverse effect on the optical exposure process in semiconductor manufacturing by ultraviolet rays emitted from the  
25 fluorescent light. Therefore, in conventional clean rooms, a yellow color coating for cutting ultraviolet light or an ultraviolet cutting filter covers the fluorescent light 24. However, when using this type of treatment, the light emitted from the fluorescent light 24 differs from natural  
30 light (white light), and since it becomes yellow light, not only is there impairment of the determination of color-differentiated markings used to mark products and the like, there are also adverse psychological effects on workers so

as to cause this method to be undesirable from the perspective of the work they perform.

Furthermore, since the fluorescent light 24 requires a necessary minimum mounting width (for example, 200 mm), a region A beneath the fluorescent light 24 becomes a retention area for airborne dust produced in the room due to an eddy in the air current generated because clean air cannot pass directly from the HEPA filter 16, such that the required degree of cleanness cannot be obtained in the clean room.

#### [OBJECT OF THE INVENTION]

In view of the previously described information, an object of the present invention is to provide an illumination device for a clean room which produces white light near natural light and eliminates ultraviolet light, and does not generate a retention area for dust due to the installation of the illumination device.

#### [SUMMARY OF THE INVENTION]

In view of the previously described information, the present invention is characterized by having light-emitting diodes arrayed on the ceiling surface, in a clean room into which is blown clean air that has passed through a high-performance filter mounted in the ceiling and from which is discharged air suctioned from the room.

#### [EMBODIMENTS]

The preferred embodiments of the clean room illumination device of the present invention are described hereinafter with reference to the accompanying drawings. FIG. 1 is a cross sectional view of a clean room provided with the illumination device of the present invention, and FIG. 2 is a bottom view of the beams provided by the illumination device of the present invention. In the

embodiment shown in FIG. 1, like parts of the clean room shown in FIG. 8 are labeled with like reference numbers and, therefore, detailed discussion of these parts is omitted. As shown in FIG. 1, a beam 23, which has a bottom surface 5 23a with a width  $ls$  of approximately 30 mm, is formed between the HEPA filters 16 and 16, and on this bottom surface 23a are disposed a plurality of red light-emitting diodes 38R, green light-emitting diodes 38G, and blue light-emitting diodes 38B. As shown in FIG. 2, individual light-emitting 10 diodes 38R, 38G, 38B with diameters of approximately 7 mm and of mutually different colors are arranged in rows of along the beam width  $ls$  of the bottom surface 23a of the beam 23, and the light-emitting diodes 38R, 38G, 38B of different colors sequentially alternate along the lengthwise 15 direction of the beam bottom surface 23a.

In the present embodiment having the above-described structure, light emitted from the light-emitting diodes 38R, 38G, 38B, which in combination form the primary colors of red, green, blue, is combined to produce a white light that 20 illuminates the room interior 20 of the clean room 10. This white light approaches natural light, and since the light from the light-emitting diodes does not have ultraviolet rays in a single wavelength, there is no adverse effect on the optical exposure process when semiconductors are 25 manufactured.

Furthermore, the light-emitting diodes 38R, 38G, and 38B can be formed in the approximately 30 mm of the width  $ls$  of the beam 23, which is not a large mounting space such as the mounting space of a fluorescent light, and the distance 30  $hs$  from the beam 23 of the dust retention area B below the beam 23 thereby becomes approximately 150 mm. The degree of cleanliness of the room interior 20 is maintained by the reduction this dust retention area B.

Moreover, FIG. 3 shows a second embodiment of the present invention, wherein like parts of the clean room shown in FIG. 8 are labeled with like reference numbers and, therefore, detailed discussion of these parts is omitted.

5 In the embodiment shown in FIG. 3, each type of light-emitting diode 38R, 38G, and 38B is provided in a part 42 that is not part of the ventilation hole 40 of the punching board 18a. According to this structure, the HEPA filters 16 on the entire surface of the ceiling space 12 are  
10 integratedly connected, and the beam 23 becomes unnecessary. Furthermore, if the punching board 18a itself is formed as a printed circuit board for the layout of the light-emitting diodes 38R, 38G, and 38B, the board 18a itself becomes the wiring board, thereby simplifying the wiring structure of  
15 the ceiling space.

Since the installation of the beam 23 is unnecessary in the embodiment having the structure described above, the dust retention of conventional devices is eliminated, and the layout of the diodes 38R, 38G, and 38B on the board 18a  
20 is simplified. A further advantage is that the thickness of the light-emitting diodes 38R, 38G, and 38B produces a rectification effect.

Furthermore, in a third embodiment shown in FIG. 4, a mounting member 44 may be suspended from the ceiling, and  
25 each type of light-emitting diode 38R, 38G, and 38B may be mounted on this mounting member 44. According to this structure, the manufacturing device 26 is directly illuminated and adequate brightness is obtained, and since the mounting member 44 on which are mounted the diodes 38R,  
30 38G, and 38B is small, there is no creation of a dust retention area.

Moreover, each light-emitting diode 38R, 38G, and 38B also may be provided at the tip of a spacer 46 used to



maintain the HEPA filters 16 at a predetermined spacing, as in a fourth embodiment shown in FIG. 5. In this instance, a mounting member for the diodes 38R, 38G, and 38B is unnecessary, the dust retention area is eliminated, and the room interior 20 is normally maintained in a clean condition.

FIG. 6 and FIG. 7 are cross sectional views of a fifth embodiment of the clean room illumination device of the present invention. As shown in FIG. 6, an HEPA filter 16 is mounted to a ceiling beam 23 via a support 60, and an illumination unit 50 is provided on the bottom surface of the HEPA filter 16. The illumination unit 50 is disposed along and beneath a bent edge of a filter 56 of the HEPA filter 16, so as to be aligned in a row beneath the bent edge of each filter 56, as shown in FIG. 7. The illumination unit 50 includes a transparent sheath 52, light-emitting diodes 38R, 38G, and 38B disposed within the sheath 52, and plugs 53 mounted on both ends of the sheath 52. The illumination unit 50, via the plugs 53, can be attached to and removed from a socket 54 provided on a support frame 58 of the HEPA filter 16, and the light-emitting diodes 38 within the illumination unit 50 are connected to a power source not shown in the drawings through the plugs 53 and the socket 54.

In the illumination unit 50 of this structure, the illumination unit 50 does not adversely affect the optical exposure process in semiconductor fabrication, and cleanliness is maintained within the clean room since a dust retention region is not easily formed. Furthermore, the air circulation outflow is not impaired.

#### [EFFECT OF THE INVENTION]

According to the clean room illumination device of the present invention as described above, illumination of the

clean room can use white light approaching natural light  
with ultraviolet light eliminated via the use of light-  
emitting diodes as light sources, and further can eliminate  
the dust retention region that accompanies the installation  
5 of an illumination device.

#### 4. BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross sectional view of a clean room  
provided with the illumination device of the present  
invention; FIG. 2 is a bottom view of a beam provided in the  
10 illumination device of the present invention; FIG. 3, FIG.  
4, FIG. 5, FIG. 6, and FIG. 7 are illustrations of other  
embodiments of the illumination device of the present  
invention; and FIG. 8 is a cross sectional view of a  
conventional clean room illumination device.

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